Case Study 2
MWRA East Boston Branch Sewer

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Problem: MWRA Combined Sewer Overflows (CSO)

- Stormwater mixes with wastewater during heavy rain events, bypasses treatment, flows directly into rivers and harbor
  - Part of Federal court order in the Boston Harbor Case
  - Final CSO Facilities Plan and EIR filed August 1997 identified 25 wastewater system improvements
  - Full Implementation of the FP/EIR recommendations to be completed by November 2008

Where are the problems?

- Reduce CSOs
  - From 3.3 billion gallons/year
  - To 0.7 billion gallons/year
- Total 84 CSO Outfalls
  - 36 closed
  - 44 reduced

Target MWRA CSO Goals

- Reduce CSO discharges into Boston Harbor and rivers
  - $ 927 MM program
  - 15 Year program timeline
  - Interceptor relief
  - Consolidation tunnels
  - Sewer separation
- Remote treatment facilities
- Rehabilitation for hydraulic relief
- Floatable controls / system optimization

East Boston branch sewer

- Constructed in 1895
- Owned and maintained by MWRA
- Conveys sanitary and storm flows from City of Boston owned Combined Sewer System to MWRA owned Deer Island Treatment Plant via Caruso Pump Station in Chelsea

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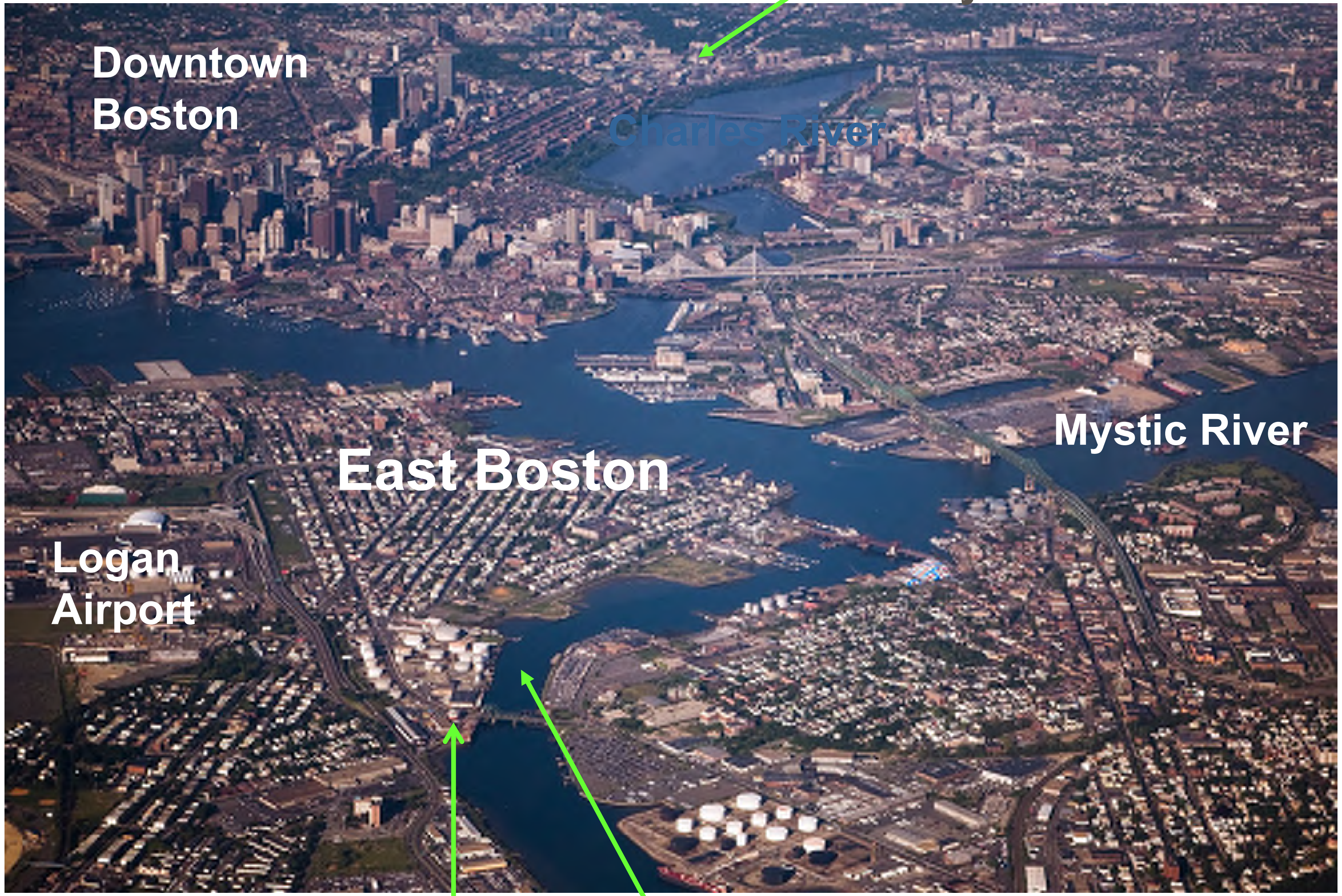
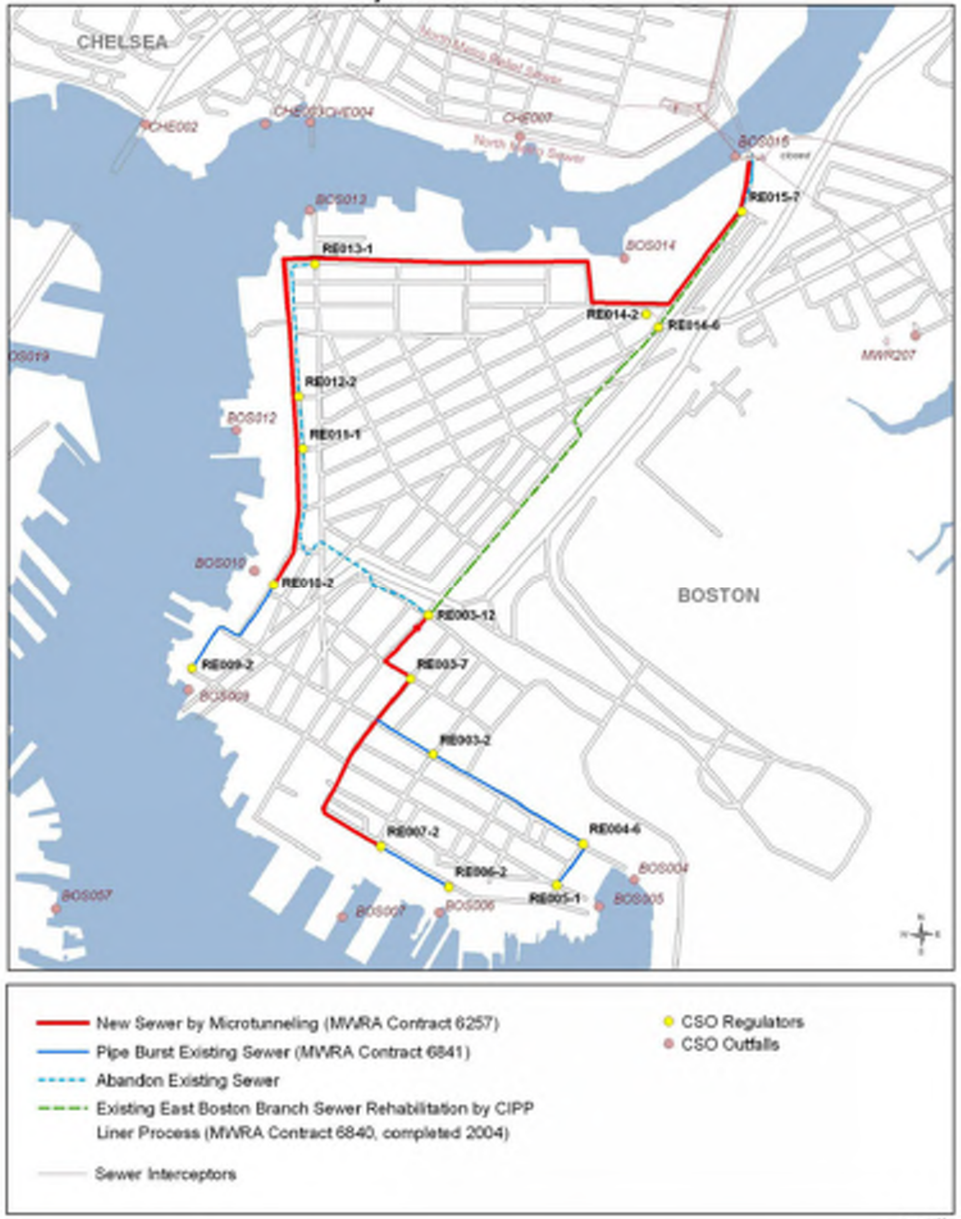


Fenway Park
Downtown Boston
Charles River
Boston Inner Harbor
Mystic River
East Boston
Logan Airport
Caruso PS
Chelsea River

Game plan

- Reduce overflows from 41 million gallons/year (MGY) to approximately 4 MGY
- Goal: Significant improvement in water quality

East Boston Branch Sewer Relief
Hydraulic Relief Plan



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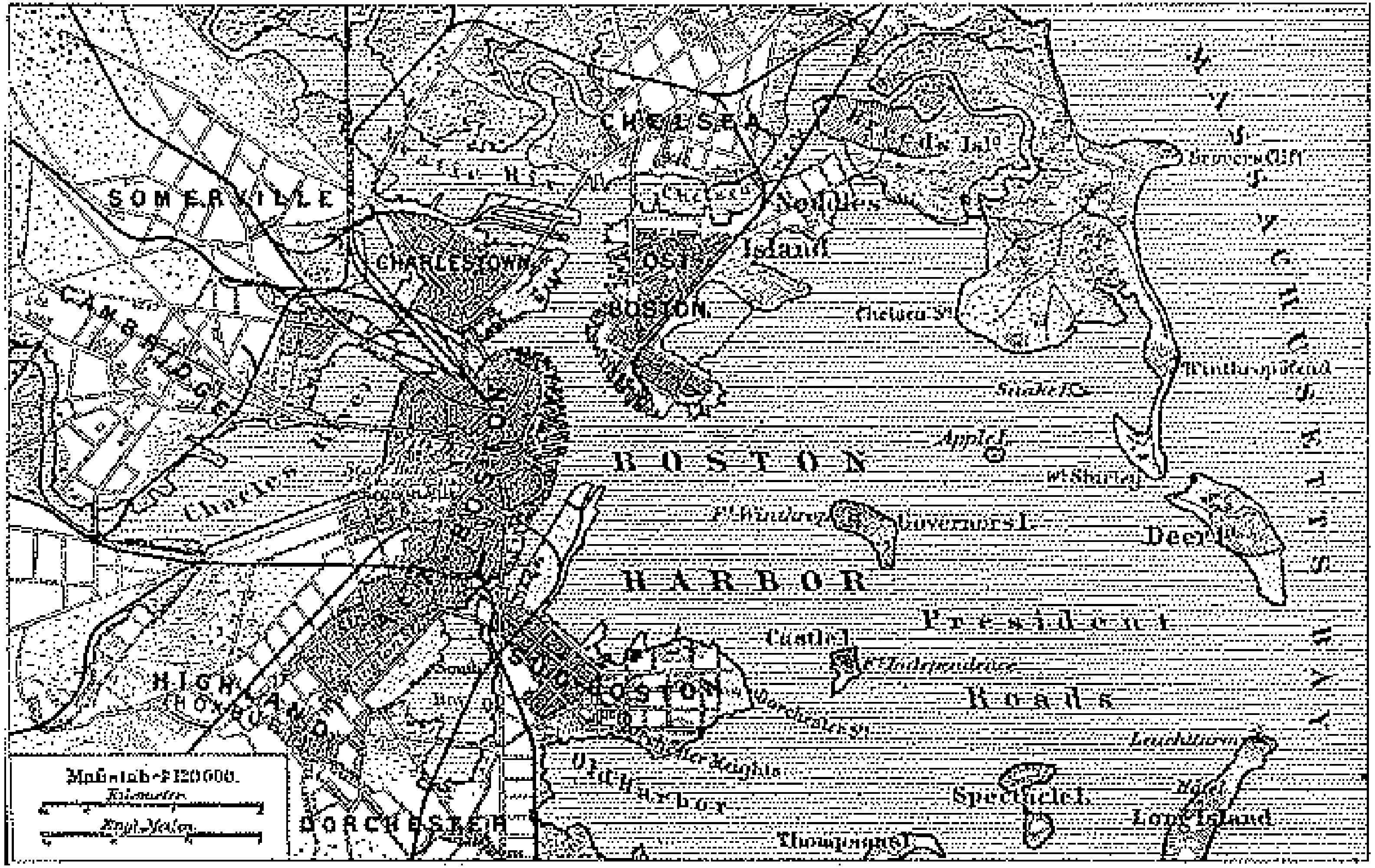
East Boston project goals

- Significantly reduce number CSO activations
  - Reduce from 181 to approximately 30 times per year
- Significantly reduce volume of overflows
  - Reduce from 45 MGY to approximately 6 MGY
- Achieve at “Best Cost”
- Minimize impact to public from construction

East Boston

- Established in 1830's
- Historical water front
- Street pattern virtually unchanged



Overview of East Boston

- Logan International airport with airport support facilities
- Extensive highway, public transit, and subway system
- Highly urbanized neighborhood of Boston with residential, industrial, and institutional activities
- Land development began in 1830's
- Active waterfront with commercial shipping and plans to revitalize and redevelop land use

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Scenes of East Boston

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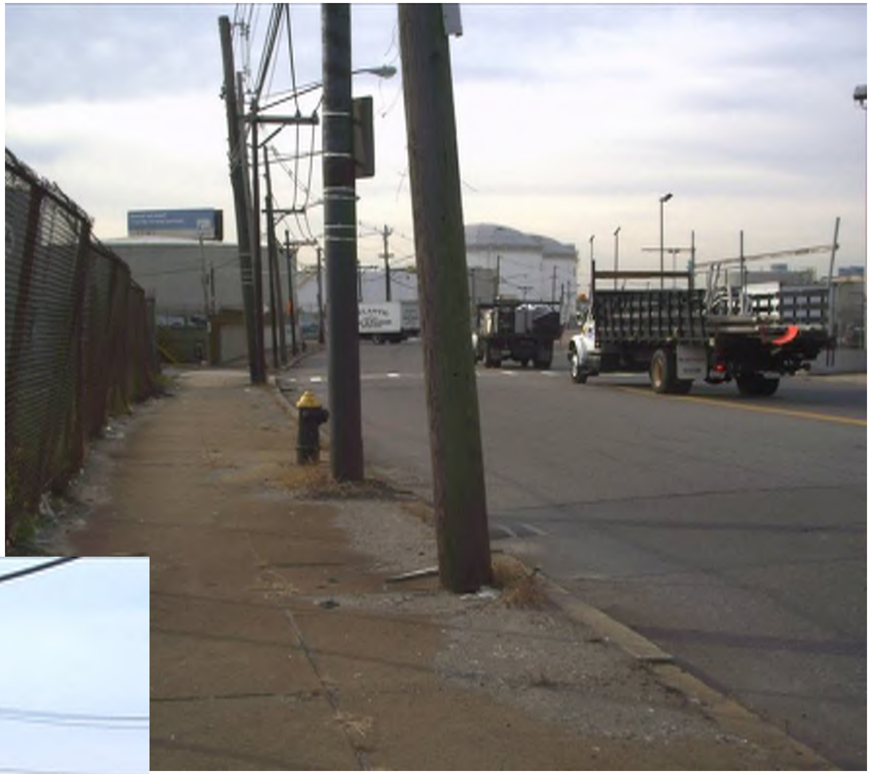
Industrial East Boston



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East Boston characteristics

- Urban Land Use
  - Senior citizens community center
  - Auto body shops
  - Schools
  - Narrow streets
  - On-street parking
  - Off-street industry
  - High traffic volumes
  - Active water front
  - Tight turning movements
  - Numerous underground utilities

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Other aspects of East Boston

- Parkland
- Flooding

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Trenchless methods considered

- Cured-in-Place Pipe (CIPP) lining
  - To improve system hydraulics
- Pipe bursting
  - To increase hydraulic capacity
- Microtunneling (MT)
  - To install Relief Sewer
- Horizontal Directional Drilling (HDD)
  - To cross under active subway, and to cross under active ship channel
- In-Line Microtunneling
  - To increase hydraulic capacity where pipe bursting was not feasible
- Open-face pipe jacking
  - To reduce risk in glacial tills
- Modified sliplining
  - To improve system hydraulics

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Subsurface explorations

- Desktop study
  - Identify existing subsurface information and site geology
- Geotechnical boring program
  - Verify and identify soil conditions and types
- Review of historical land use maps
  - Identify potential obstructions
- Ground penetrating radar (GPR)
  - Locate abandoned seawalls and old building foundations
- Probing
  - Verify results of GPR
- Review record information on utilities
- Subsurface hazardous material assessment program
  - Identify risk of encountering contaminated material, and quantify the associated mitigation cost

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Results of subsurface exploration program

- Determined complex soil conditions
  - including glacial tills, marine clays, peat, filled land, marine sands, and high groundwater
- Determined locations, types, and severity of contaminated soils and groundwater
  - Consisting mostly of petroleum fuel by-products
- Identified location of (some) potential obstructions to microtunnel machine
  - Abandoned seawalls and building foundations
- Identified planimetric location of other utilities
  - To assist in locating jacking and receiving shafts, and minimize utility conflicts

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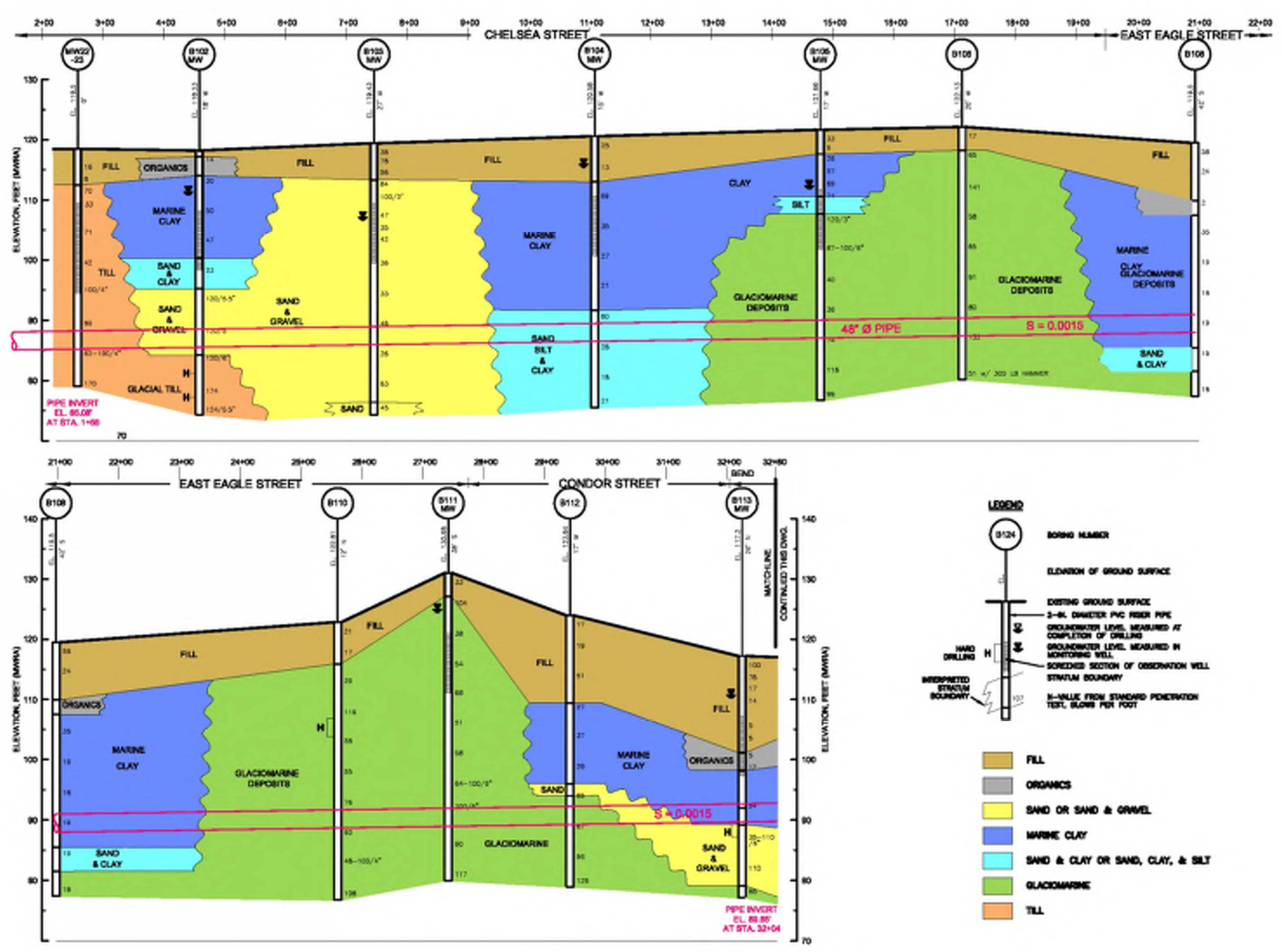

CHELSEA STREET
EAST EAGLE STREET
CONDOR STREET
ELEVATION, FEET (MWRA)
FILL
ORGANICS
MARINE CLAY
SAND & CLAY
SAND & GRAVEL
TILL
GLACIAL TILL
SAND
CLAY
SILT
SAND SILT & CLAY
GLACIOMARINE DEPOSITS
48" Ø PIPE
S = 0.0015
PIPE INVERT EL. 85.08' AT STA. 1+68
PIPE INVERT EL. 89.88' AT STA. 32+04
BEND
MATCHLINE CONTINUED THIS DWG.
GLACIOMARINE
LEGEND
BORING NUMBER
ELEVATION OF GROUND SURFACE
EXISTING GROUND SURFACE
2-IN. DIAMETER PVC RISER PIPE
GROUNDWATER LEVEL MEASURED AT COMPLETION OF DRILLING
GROUNDWATER LEVEL MEASURED IN MONITORING WELL
HARD DRILLING
SCREENED SECTION OF OBSERVATION WELL
STRATUM BOUNDARY
INTERPRETED STRATUM BOUNDARY
N-VALUE FROM STANDARD PENETRATION TEST, BLOWS PER FOOT
FILL
ORGANICS
SAND OR SAND & GRAVEL
MARINE CLAY
SAND & CLAY OR SAND, CLAY, & SILT
GLACIOMARINE
TILL

Identifying shaft locations

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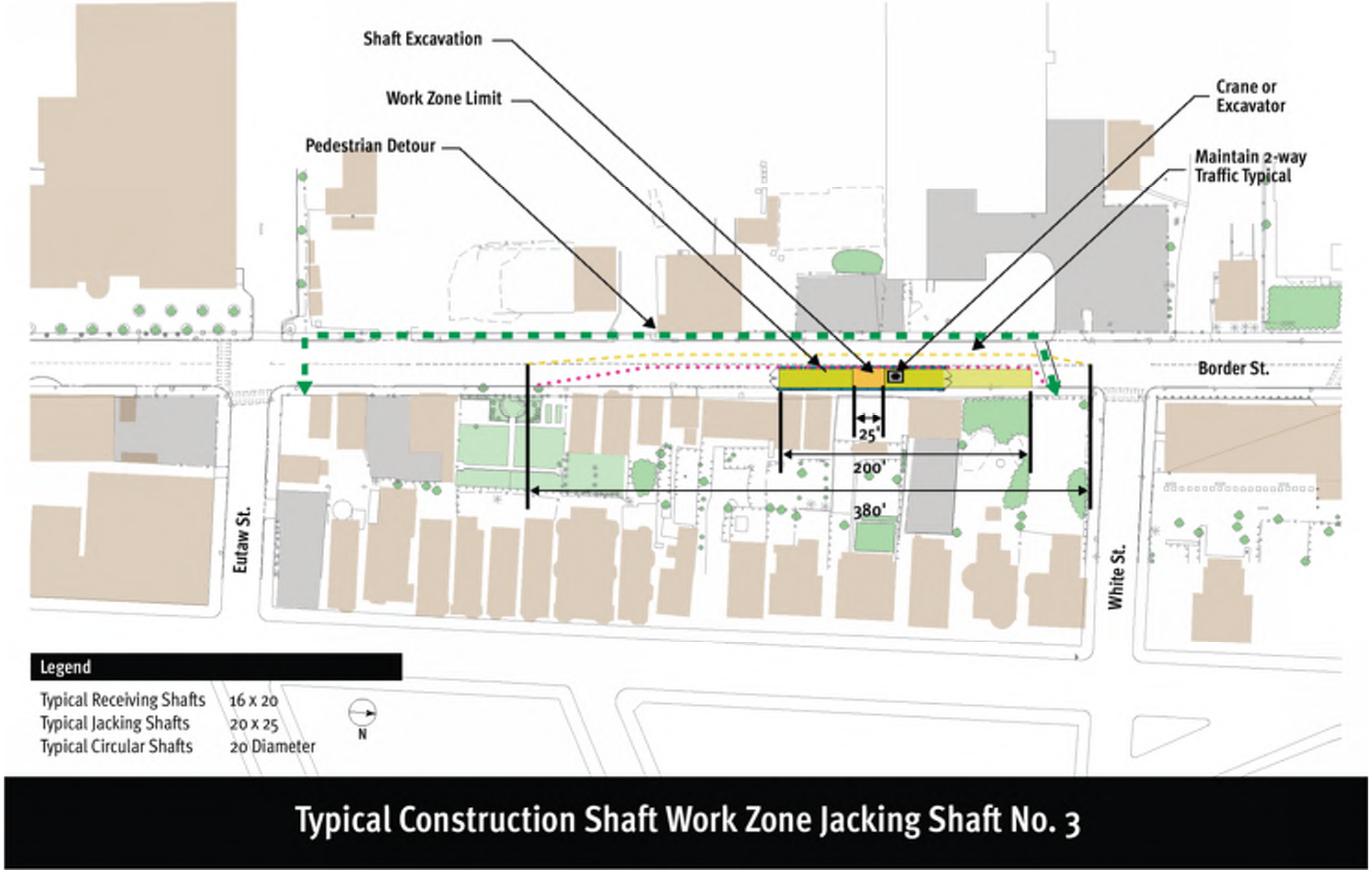
Shafts

Work zone



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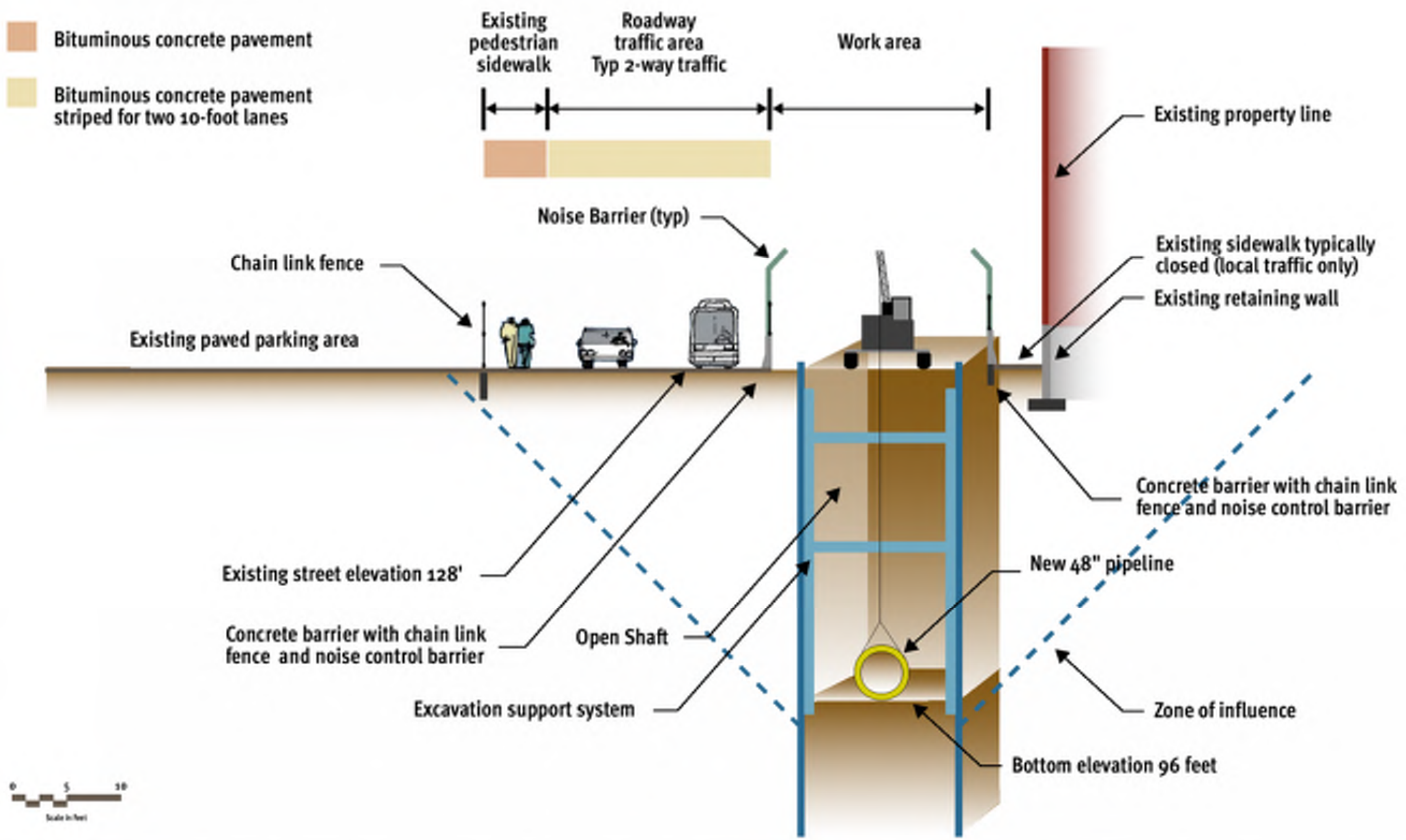
Jacking shaft profile



Border Street Cross Section through Jacking Shaft No. 3 Looking North

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Tight workspaces

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Coordination with other agencies

- Boston Water and Sewer Commission
  - Owners and operators of City of Boston sewer system
- MassPort
  - Operators of Logan International airport and waterfront commercial property
- MBTA
  - Owners and operators of local bus transit and subway system
- MassHighway
  - Owner and constructor of Central Artery/Tunnel (CA/T) project
- Boston Transportation Dept
  - Responsible for traffic management in City of Boston
- Boston Public Works Department
  - Responsible for construction permits for work within the streets of Boston

Overarching Project Design Goals

- Reducing the need to relocate utilities
- Avoiding known obstructions
- Determining feasible locations for jacking and receiving shafts
- Minimizing adverse traffic impacts during construction
- Minimizing the need for handling and disposal of contaminated soils and groundwater
- Minimizing impacts on local residents and businesses
- Providing an operable and maintainable sewer system when completed

Construction Activities

By-Pass Pumping

- Installed temporary by-pass pump system to handle 20 millions gallons per day (MGD)

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Construction Contracts

- Contract 1: (MWRA Contract # 6257)
  - Barletta Heavy Division, with Cruz Corporation as the microtunneling specialty contractor
  - Approximately two miles of 48-inch diameter interceptor by microtunnel
  - In-line microtunneling of approximately 1,900 feet of 36-inch diameter pipe
  - Approximately 1,000 feet 66-inch pipe that will be installed by microtunnel
  - Scheduled Completion in July 2010
  - Bid Price $59.9M
- Contract 2: (MWRA Contract # 6840)
  - D'Alessandro Corporation, with Insituform Technologies and Godwin Pump
  - Rehabilitation of approximately 5,400 feet of the existing 36-inch x 42-inch upside down horseshoe shaped East Boston branch sewer (EBBS) main trunk sewer using CIPP
  - Completed in 2004
  - Bid Price $5.2M

Construction Contracts

- Contract 3: (MWRA Contract # 6841)
  - P. Caliacco Corporation, with D'Alessandro Corporation
  - Approximately one mile of the existing EBBS system using pipe bursting technique
  - Scheduled completion in July 2010
  - Bid Price $7.3M

Further Reading

- Periodicals such as: Trenchless Technology Magazine, Underground Construction Magazine, World Tunneling, North American Pipelines, and Utility Contractor
- Conference Proceedings from: No-Dig, Underground Construction Technology (UCT), ASCE Pipelines, as well as WEF, ASCE, and AWWA
- Books / Manuals: Trenchless Technology-WEF Press; Gravity Sanitary Sewer Design and Construction – ASCE/WEF
- Trenchless Technology for the Installation of Cables and Pipelines Benjamin Media;
- Guide to Best Practice for the Installation of Pipe Jacks and Microtunnels – Benjamin Media

Standards Related to Trenchless Technology

- ASCE 36-14: Standard Design and Construction Guidelines for Microtunneling
- AWWA M45: Fiberglass Pipe Design Manual
- ASTM D3262: Specifications for Fiberglass Sewer Pipe
- ASTM D4161: Specifications for Fiberglass Pipe Joints using Flexible Elastomeric Seals
- ASTM F477: Specifications for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- ASTM C936: Infiltration Testing
- ASTM D2412: Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel – Plate Loading
- ASTM C1208: Vitrified Clay Pipe and Joints for Use in Jacking, Sliplining, and Tunnels

Standards Related to Trenchless Technology

- ASTM C301: Standard Test Methods for Vitrified Clay Pipe
- ASTM C828: Standard Test for Method for Low Pressure Air Test of Vitrified Clay Pipe Lines
- ASTM C425: Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings
- ASTM C700: Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
- EN 295 – Part 7 – Requirements for Vitrified Clay Pipes and Joints for Pipe Jacking
- ASTM C76: Specifications for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
- ASTM C443: Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

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